

## STATIC AND DYNAMIC PYROELECTRIC PROPERTIES OF PVDF

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**Abstract** The pyroelectric properties of polyvinylidene fluoride (PVDF) have been investigated with a new procedure for the simultaneous measurement of the pyroelectric coefficient under quasistatic and dynamic conditions. The sample is heated at a uniform rate with an overlaid sinusoidal temperature modulation. The dc and the ac component of the electric current are recorded, and the dc and ac components of the temperature are measured with a thin film resistive bolometer. The quasistatic measured pyroelectric coefficient is higher than the dynamic one, with a quotient of both quantities up to three. The frequency dependence of the pyroelectric coefficient has been investigated down to  $10^{-3}$  Hz, showing a contribution of free charges to the pyroelectric current for frequencies below the reciprocal dielectric relaxation time. The results show, that the polarization of the crystalline regions is locally compensated by charge, and that even a small change of the polarization is compensated within a time scale of  $10^{-3}$  s.

### INTRODUCTION

Various experimental procedures are common for the measurement of the pyroelectric coefficient. One of them is the quasistatic temperature ramp method, which is based on the heating of the sample under investigation at a uniform rate, while the electric current is recorded. The dynamic radiant heating method is realized by a periodic heating of the sample by the absorption of intensity modulated radiation and a measurement of the resulting alternating current. The radiant heating method had been introduced for the measurement of qualitative pyroelectric data<sup>1</sup> and had been applied to PVDF for investigations of the thermal stability<sup>2</sup>. Utilizing thin film thermometers for the temperature measurement, the pyroelectric coefficient of thin polymer films can be determined quantitatively<sup>3</sup>. Systematic differences, which had been obtained by both methods applied to PVDF and P(VDF-TrFE)<sup>4</sup>, were the motivation for a more detailed investigation.

### SAMPLE PREPARATION AND EXPERIMENTAL ARRANGEMENTS

The investigated samples were 9  $\mu\text{m}$  thick biaxially stretched PVDF films. On each side